B.Tech. SEM -IV (Civil) 2014 Course (CBCS) : SUMMER - 2019
SUBJECT : ENGINEERING MATHEMATICS – III

Day : Thursday
Date : 23/05/2019

Time : 10.00 AM TO 01.00 PM
Max. Marks : 60

S-2019-2597

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.

Q.1 **a)** Solve by variation of parameters : $\left(D^2+3D+2\right)y=e^{e^x}$. **[05]**

b) Solve : $\dfrac{dx}{x\left(2y^4-z^4\right)}=\dfrac{dy}{y\left(z^4-2x^4\right)}=\dfrac{dz}{z\left(x^4-y^4\right)}$. **[05]**

OR

a) Solve : $\left(D^2-D-2\right)y=2\log x+\dfrac{1}{x}+\dfrac{1}{x^2}$. **[05]**

b) Solve : $(1+x)^2\dfrac{d^2y}{dx^2}+(1+x)\dfrac{dy}{dx}+y=2\sin\left[\log(1+x)\right]$. **[05]**

Q.2 A horizontal tie-rod is freely pinned at each end. It carries a uniform W kg per unit length and horizontal pull P. Find the central deflection and maximum bending moment, taking the origin at one of its ends. **[10]**

OR

If $\dfrac{\partial^2 y}{\partial t^2}=c^2\dfrac{\partial^2 y}{\partial x^2}$ represents the vibrations of a string of length l fixed at both ends, find the solution with boundary conditions: **[10]**

i) $y(0,t)=0$

ii) $y(l,t)=0$

iii) $\left(\dfrac{\partial y}{\partial t}\right)_{t=0}=0$ and initial condition

iv) $y(x,0)=k(lx-x^2),\ 0\le x\le l$

Q.3 Solve the following system of equations by Gauss – Seidel iteration method: **[10]**

$27x+6y-z=85$

$6x+15y+2z=72$

$x+y+54z=110$

OR

Use Runge Kutta method of fourth order to solve $\dfrac{dy}{dx}=1+\sqrt{xy};\ y(0)=1$ to find y at $x=0.2$ taking $h=0.1$. **[10]**

P.T.O.

Q.4 Find the first four moments of the following distribution about the mean and hence find β_1 and β_2. **[10]**

Marks obtained	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of students	1	6	10	15	11	7

OR

a) A can hit the target 1 out of 4 times B can hit the target 2 out of 3 times. C can hit the target 3 out of 4 times. Find the probability that atleast two hit the target. **[05]**

b) In a test on 2000 electric bulbs it was found that the life of a particular make was normally distributed with an average time 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely burn for more than 1920 hours but less than 2160 hours. (Given $z = 2$, Area = 0.4772). **[05]**

Q.5 a) Find the directional derivative of $\phi = e^{2x}\cos yz$ at (0, 0, 0) in the direction of tangent to the curve $x = a\sin t,\ y = a\cos t,\ z = at$, at $t = \frac{\pi}{4}$. **[05]**

b) If $\rho\overline{E} = \nabla\phi$, prove that $\overline{E}.curl\ \overline{E} = 0$. **[05]**

OR

Prove that : **[10]**

i) $\nabla^2\left[\nabla\bullet\left(\frac{\overline{r}}{r^2}\right)\right] = \frac{2}{r^4}$.

ii) $\nabla\times\left(\frac{\overline{a}\times\overline{r}}{r^3}\right) = -\frac{\overline{a}}{r^3} + \frac{3\left(\overline{a}\bullet\overline{r}\right)}{r^5}\overline{r}$.

Q.6 Verify Gauss Divergence theorem for $\overline{F} = \left(x + y^2\right)\hat{i} - 2x\hat{j} + 2z\hat{k}$ over the volume of the tetrahedron bounded by co-ordinate planes and the plane $x + y + z = 1$. **[10]**

OR

Verify Stokes theorem when $\overline{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$, where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is the boundary. **[10]**

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